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The Relationship of Blood Pressure Self-Monitoring and Hypertension Control

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Abstract

The purpose of this structured literature analysis is to review the relationship of blood pressure self-monitoring and hypertension control. Blood pressure self-monitoring can help reduce the high blood pressure burden among people with hypertension, minimize the risk of heart disease and related complications. Self-care is an important component in managing chronic illness. Self- monitoring of blood pressure may allow people with hypertension to be concerned about their long-term health. Furthermore, blood pressure self-monitoring may lead to lifestyle modification behaviors and adherence to treatment. The positive relationship of blood pressure self- monitoring and hypertension control may help people to understand the effectiveness of blood pressure self-monitoring in long-term management of hypertension. This paper utilized the electronic database to search for literature. This structured literature analysis helped with providing information on how close blood pressure self-monitoring assist people with hypertension and health care providers in managing hypertension concomitantly.

Keywords: Blood Pressure Self-monitoring, Hypertension, Treatment adherence, Lifestyle modification

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CHAPTER I INTRODUCTION

Hypertension is a significant world health challenge and leading cause of morbidity and mortality. More than one billion people have hypertension globally (World Health Organization, 2018). In the United States (US), almost 50% of the adult's population that is 103 billion people have hypertension American Heart Association (AHA), 2018). Hypertension is the third ranked factor in bringing disability in later life years (Chockalingam, Campbell, & Fodor, 2006).

Adequate management of hypertension is essential to impede complications and enhance quality of life. Hypertension can damage blood vessels and different body organs. The damage is greater when the high blood pressure goes on for longer periods of time increasing the risk for strokes, peripheral vascular disease, heart attacks, and heart failure (American Heart Association, 2017).

In 2013, the major reason for death in the U.S. was cardiovascular causes, in which hypertension was responsible for 360,000 deaths. That is just about 1,000 deaths every day. Interestingly, 20% of people who have hypertension are still unaware that they have it (Mozaffarian et al., 2015). Increased levels of knowledge and concern about hypertension could influence people to find ways to control the hypertension (Fariba Samadian, Nooshin Dalili, & Ali Jamalian, 2016).

The situation in which a person measures their own blood pressure at any location outside a clinic (home, work place) is the self- monitoring of blood pressure (BP) (McManus et al., 2008). The multiple measurements from self-monitoring lead to information about variation and accurate measurement (McManus et al., 2008). BP self-monitoring can promote individual self-care that promotes management of hypertension and minimizes hypertension-related complications. Blood pressure self-monitoring gives people feedback on how well they are

managing their blood pressure. This can motivate them to take their medications as prescribed and/or make life style changes.

Hypertension self-management behaviors are associated with hypertensive individual perceptions. Bokhour et al., (2012) found that a person with hypertension beliefs about cause, symptoms, and effectiveness of hypertension treatment affect their hypertension management behaviors. Additionally, daily lifestyle experiences of people with hypertension such as habits and routine, choices, associated health problems, and obstacles to exercises are some factors that interfere with optimal hypertension self-management (Bokhour et al., 2012).

This structured literature analysis focuses on BP self-monitoring to support and motivate self-care in hypertension management. BP self-monitoring of blood pressure can help reduce the high BP burden, risk of heart problems and associated complications by influencing lifestyle modification and treatment adherence (Tucker, 2017). Therefore, motivation for BP self-monitoring practice have been encouraged.

Statement of problem

BP self-monitoring can be an effective component in achieving hypertension control, but how this helps is not clear. The probable factors include an awareness of their blood pressure readings can increase adherence to antihypertensive medicines and lifestyle changes as high blood pressure does not have any symptoms until end organ damage has occurred. Thus, people can be completely unaware that their blood pressure is elevated.

The prevention and control of hypertension is hindered by lots of hurdles with medical service system, health professionals, and self-management behaviors of hypertensive. Those hindrances comprise lack of health care accessibility, expensive treatments, difficulties in adopting strict guidelines, low health literacy, and medication adverse effects (Committee on

Public Health Priorities to Reduce and Control Hypertension in the U.S. Population et al., 2010). Chobanian et al., (2003) stated most of the individuals who don't have well controlled blood pressure lack encouragement in the form of serious conversation of treatment adherence from their health care provider. The main individual-level barriers to medical advice and treatment adherence are asymptomatic state of hypertension and long-term use of medicines. People do not find they have hypertension unless they have a health care encounter or appointment (Krousel-Wood et al., as cited in Breaux-Shropshire et al., 2012). They are not able to tell when their medications are controlling their blood pressure as well. These are demotivating factors in continuing life-long treatment.

Hypertension management does not solely depend upon health care professionals. The patients' motivation and engagement to take prescribed medication and adopt healthy behaviors is also important (Chobanian et al., 2003). Lifestyle modifications such as: regular exercise, following the DASH diet, reducing sodium diet consumption, limiting alcohol intake and stopping smoking are non-pharmaceutical or self-care approaches to hypertension management (Campbell & Niebylski, 2014). Identifying the relationship of BP self- monitoring and hypertension control could contribute to improvement in hypertension control and outcomes.

Research question

What is the relationship of blood pressure self-monitoring and hypertension control?

Operational definition of key terms

Hypertension: In 2017 the American Heart Association (AHA) changed the definition of hypertension to 130/80 mm Hg in adults and older adults. In contrast the American Academy of Family Physicians (AAFP) and American College of Physicians (ACP) continue to define it as

140/90 mm Hg and 150/90 mm Hg in older adults. However, these definitions have not been accepted worldwide. Thus, the Centers for Disease Control and Prevention is continuing to utilizing the previous definition of 140 mm Hg/90 mm Hg (Center for Disease Control and Prevention, 2017). This structured literature analysis will also use this definition of hypertension.

Self-monitoring of blood pressure: Self-monitoring of blood pressure is measuring blood pressure at home or any setting by people with hypertension or caregiver.

Lifestyle modification: The behaviors that help to control hypertension such as physical exercise, low sodium diet, low cholesterol diet, reduce the intake of alcohol, and stopping smoking.

Medication adherence: The World Health Organization (WHO) defines medication adherence to long-term medication taking behavior. However adherence is not only defined to taking medicines but also adherence to other recommendations and healthy lifestyle behaviors. Adherence presumes the person's concurrence with the recommendations (Brown & Bussell, 2011).

CHAPTER II LITERATURE REVIEW

The purpose of this structured literature analysis is to find the relationship between self-monitoring of blood pressure and hypertension control. In this chapter, this structured literature analysis review the definition of hypertension, target blood pressure goals, hypertension epidemiology, methods of hypertension management, and self-monitoring of blood pressure in hypertension management.

Hypertension

Considering current recommendations, choosing the most appropriate BP goals, particularly for individual ≥60 years has been debated. Discussion about the objective for systolic BP (SBP) among treated hypertensive older adults has heightened. The 2017 AHA definition of hypertension differed from the AAFP and ACP when they revised the definition of hypertension. The AHA defines hypertension as "a systolic and diastolic blood pressure of 130/80 mm Hg or higher that remain elevated over time" (American Heart Association, 2017., para. 4).

The ACP and the AAFP suggest that providers start treatment in individuals 60 years and older with SBP at or over 150 mm Hg to accomplish an objective systolic blood pressure of under 150 mm Hg to lessen the risk for stroke, cardiac events, and conceivably mortality. ACP and AAFP also indicated that clinicians select the treatment objectives for people of age 60 years or more dependent on a regular talk of the advantages and harms of particular blood pressure target focuses with the patient (Qaseem, Wilt, Rich, Humphrey, Frost, & Forciea, 2017., para. 4). Comorbid conditions are need to be considered by physicians while choosing BP target focuses for adults aged 60 years or more that could influence treatment decisions (Qaseem, et. al., 2017). Similarly, the author suggested that management of hypertension incorporate behavior

modification, for example, weight reduction, dietary change, physical exercise, and adherence to antihypertensive prescriptions.

The 2017 American College of Cardiology (ACC)/AHA guidelines suggest antihypertensive drugs for all adults with hypertension. Furthermore, anti-hypertensive medications are recommended for adults with high cardiovascular disease (CVD) risk with systolic blood pressure (SBP) of 130-139 mm Hg or diastolic blood pressure (DBP) of 80- 89 mm Hg and adults ≥65 years of age with SBP of 130- 139 mm Hg by the 2017 ACC/AHA guideline (Muntner et al., 2018., para. 1).

As per the 2017 ACC/AHA Hypertension Guidelines, numerous adults in the United States are prescribed antihypertensive drugs. Likewise, for majority of adult population with SBP/DBP of 130-139/80-90 mm Hg, 2017 ACC/AHA has recommended the non-pharmacological measures alone as the initial prescribed treatment (Muntner et al., 2018). The purpose of the lower definition of hypertension is to early initiation of hypertension management and to reduce hypertension related complications (Bonner, 2018).

The authors of the 2017 ACC/AHA guideline concluded that the hypertension diagnosis creates an opportunity for providers and people with hypertension to talk about non-pharmacological management in bringing down BP, to execute prescribed way of life changes, and to stress that high BP can be managed (Muntner et al., 2018).

Epidemiology of hypertension

Hypertension is major health problem globally and the leading cause of morbidity and mortality. Half of the cardiovascular diseases are due to uncontrolled hypertension (Bhagani, Kapil, & Lobo, 2018).

The estimated population living with hypertension was 1.39 billion, and since 2000, the number of people with hypertensionhad gone up by 466.8 million (Mills et al., 2016). In 2010, the prevalence of people with hypertension was almost triple in economically developing countries than in developed countries. In economically developing countries, middle aged groups were highly affected while in developed countries, the hypertension burden was more in older adults (Mills et al., 2016). In 2010, only 46 % of people with hypertension were aware about their condition globally. Similarly, 36.9% received antihypertensive medication, and only less than 15% had controlled blood pressure (Mills et al., 2016). According to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC-7), hypertension awareness is more than two- thirds in the US. Among people with hypertension, 59% received treatment, and hypertension control was reported in one third of those being treated. Significantly, two-thirds of the people of age 65 and over have hypertension (Chobanian et al., 2003).

In 2015-2016, 29% of adults had hypertension in the USA. Similar prevalence of hypertension was found in both males and females, that is, 30.2% and 27.7% respectively (Fryar, Ostchega, Hales, Zhang, & Kruszon-Moran, 2017). Non-Hispanic blacks had greater hypertension prevalence (40.3%) than non-Hispanic whites (27.8%). The prevalence of hypertension in males and females aged 40 to 59 years was 37.2% and 29.4% respectively. However, in older adults aged 60 and over, the hypertension prevalence was more in females (66.8%) than males (58.5%) (Fryar, Ostchega, Hales, Zhang, & Kruszon-Moran, 2017).

Management of hypertension

As people age, arterial stiffness increases reducing the elasticity of blood vessels which results in elevated blood pressure. Hence, old age itself is a hypertension risk factor. Also,

lifestyle factors such as alcohol consumption, smoking, sedentary lifestyle, and non- DASH diet are thought to be the risk factors for hypertension in old age (Bhagani, Kapil, & Lobo, 2018). Hypertension is categorized as either primary or secondary. If the cause is not clearly known (it could be genetic, environmental, or a lifestyle factor) then it is primary or essential hypertension, whereas secondary hypertension has of known origin. (Bhagani, Kapil, & Lobo, 2018). Basically, the providers diagnose hypertension and prescribe therapy. Follow up appointments are the method of monitoring the patient's response to treatment (Logan, 2013). People believe that taking medicines only can control hypertension. However, there are pharmacological and non-pharmacological methods of managing hypertension. The pharmacological treatment (antihypertensive medicine) of hypertension aims to decrease the morbidity and mortality by reducing cardiovascular and renal disease risks (Chobanian et al., 2003). Regardless of the accessibility of effective antihypertensive medicines, the blood pressure can't be well controlled in around 70% of hypertensives who get just pharmaceutical treatment (Selçuk, Çevik, Mercan, & Koca, 2017).

Hypertension management is multifaceted. The commitment of patients, families, health care providers, health services, and community play an important role in managing high BP effectively (Chobanian et al., 2003). This incorporates awareness of people with hypertension and clinicians, appropriate adjustment of lifestyle behaviors, evidence based treatment and adherence, and sufficient follow up. In spite of the fact that behavior modification may result in declines in blood pressure, people with hypertension for the most part typically require at least one drug to bring down blood pressure (Chobanian et al., 2003). Non pharmacological intervention targets lifestyle behaviors. Behavior modifications incorporates moving toward or maintaining ideal body weight, increasing physical activity, stopping smoking, constraining

alcohol consumption, and receiving healthy diet intervention (Vamvakis, Gkaliagkousi, Triantafyllou, Gavriilaki, & Douma, 2017).

The Dietary Approach to Stop Hypertension (DASH) diet is presently considered the best non pharmacological method for hypertension prevention and management. It can contribute to 11mmHg reduction of blood pressure in people with hypertension (Whelton et al., 2017). In a later meta-analysis including 23,858 respondents, it was found that strict adherence to a DASH diet brought about significant decreases in both systolic (7.62 mm Hg) and diastolic (4.22 mm Hg) blood pressure **(**Gay, Rao, Vaccarino, & Ali, 2016). The sodium intake of 2300 mg in a day is the current recommended daily allowance in the US (Centers for Disease Control and Prevention, 2017). Though a further decrease to 1500 mg in a day is suggested for the people with or at risk of developing hypertension (Van Horn, 2015). Cook et al., (2007).In a 15-year longitudinal study uncovered that sodium limitation in diet diminishes the risk of cardiovascular occasions by 25%. meta-analysis consisting of 36 studies and 2,865 participants uncovered that limiting 6 drinks of alcohol to 3 drinks per day (12 g pure alcohol per drink) decreased in SBP (5.5mm Hg) and DBP (3.97 mm Hg).Physiological stress causes a transient rise in blood pressure but periodic stress and anxiety can prolong hypertension (Sparrenberger et al., 2009). The American Heart Association (2014) recommended weight reduction to bring down the blood pressure for overweight and obese people. The body mass index (BMI) for the overweight individual is 25 to 29 kg/m2 and the obese individual is >30 kg/m2.

Akbarpour and colleagues (2018) found an important association among antihypertensive medicines, lifestyle modifications, and hypertension control. Better hypertension control was observed among individuals who were depended on healthy lifestyle behaviors but not taking antihypertensive medicines than who were taking antihypertensive medicines alone. People with

hypertension who only depended on antihypertensive medicines did not have well-controlled blood pressure. Thus, the authors suggested that people who are hypertensive should adopt lifestyle modification behaviors along with antihypertensive medications in order to achieve adequate hypertension control.

Self- monitoring of blood pressure

In developed countries, around 70% of people with hypertension routinely evaluate blood pressure at home (Logan, Dunai, McIsaac, Irvine, & Tisler, 2008). According to the Centers for Disease Control and Prevention (CDC) (2013), in the event that the blood pressure monitoring equipment is automated, an upper arm cuff, has memory storage ability, has its accuracy checked by a doctor or attendant after purchase, and is validated by the Advancement of Medical Instrumentation (AAMI), British Hypertension Society (BHS), or Environmental Health Safety (EHS), at that point it is a dependable equipment for home BP monitoring.

McManus et al., (2008) discussed some probable disadvantages of self-monitoring of blood pressure. Treatments are not only based on self-measurement of blood pressure. Treatment decisions can be made based on BP measurement using both home monitoring along with office monitoring. Inaccurate method, invalidated device, and wrong interpretation may lead to inappropriate interpretation and under or over-medication. Simple blood pressure variation may cause nervousness in the person. Motivation from a healthcare professional and one-self is also essential for BP self-monitoring (McManus et al., 2008).

The 2017 Guidelines for the prevention, detection, evaluation, and management of high blood pressure in adults featured the significance of home BP monitoring utilizing the appropriate procedure and approved equipment. To get an exact measure and detection of white-coat hypertension and masked hypertension the writers prescribe recording few blood pressure

readings no less than two times each day (Whelton et al., 2018). Likewise, the guidelines suggest self-monitoring of blood pressure (SMBP) estimations for assessment of most people with known or risk of hypertension to evaluate reaction to treatment and perhaps enhance adherence. Whelton et al., (2018) provided the steps that should be followed to monitor the blood pressure besides clinic setting are as follows: (1) always measure the blood pressure with the same apparatus at the same time every day to precisely compare the measurements, (2) in a sitting position, not crossing legs, with both feet flat on the floor, position the cuff above the elbow, (3) every morning before taking medicine and at night before dinner, take at least 2 measurements each after one minute apart, (4) after treatment or taking medicine, monitor and record blood pressure for two weeks and the week prior to clinic visit, (5) bring all the records to every clinic visits for feedback and making a treatment decision.

The standard of the Japanese guidelines is that self-monitoring of BP isn't just an instrument for hypertension screening and antihypertensive medication choices but is an apparatus for a way of lifestyle adjustment and the self-care of hypertension (Imai, Obara, Asamaya, & Ohkubo, 2013). SMBP is an effective and practical approach to identify and observe BP in daily life and is convenient for detecting changes in BP actuated by treatment. SMBP gives prompt response to hypertensive people and may enhance adherence to prescription and encourage them to manage uncontrolled BP (Imai, Obara, Asamaya, & Ohkubo, 2013).

Though the effects of BP self-monitoring have been analyzed through various randomized control trials, the clinical outcomes are not examined. Cappuccio et al., (2004) examined eighteen studies of randomized control trials in a meta-analysis. Cappuccio et al., (2004) assigned 1,359 essential hypertensive people in the intervention group for home BP monitoring while 1,355 people were assigned in the non-intervention group. The follow-up

period was in 2-36 months. The outcome of the meta-analysis were minor reductions, i.e. 2.2/1.9 mm Hg of blood pressure in the self-monitoring group, while the true effects might be less because of the consistency effect of the studies included in this meta-analysis. However, when assessed in health-care setting, large proportions of the participants were able to achieved targeted blood pressure (Cappuccio et al., 2004).

SMBP joined with hypertension knowledge was depicted as helpful program in increasing hypertensive people self-adequacy. This supports the evidence from previous studies that demonstrate that adding instructive help to SMBP is more effective than self-monitoring of BP alone (Uhlig, Patel, Kitsios, & Balk, 2013). Strikingly educational interventions have not ended up being compelling in hypertension management (Glynn, Murphy, Smith, Schroeder, & Fahey, 2010), proposing that hypertension knowledge and SMBP may have a collective impact. They suggested that future research can explore the collaboration between hypertension education programs and SMBP.

Huff et al., (2011) conducted a quality development project to identify the factors that help people adhere to home monitoring of blood pressure. They conducted a telephone survey among the non-participants (drop out participants who did not report or communicate the results of home BP monitoring) of an Achieving Cardiovascular Excellence in Colorado (A CARE) program. They found that more than two-third of the non-participants were still monitoring the home BP. However, the reason behind not participating and reporting the results were mostly personal and the clinical. The personal factors were time constraint, laziness and forgetfulness whereas no appointments with health care providers, not seeking the results by health care providers, and self-thinking on health care provider that they wouldn't care were the reasons for not interacting the measurements with health care providers (Huff et.al., 2011). They suggested

that home BP education, motivational interactions, follow-up, and reminder strategies can be valuable strategies to increase adherence to home BP monitoring.

The results of the study "Self-Measurement of Blood Pressure at Home Reduces the Need for Antihypertensive Drugs," a randomized, controlled trial showed that self-blood pressure measurement may decrease the numbers of antihypertensive drugs with the continuation of office BP monitoring (OBPM). Overall, Verberk et al., (2007) stated that BP self-measurement can be an invaluable means for health care provider to adjust the medicine and avoid inessential prescription of antihypertensive drugs.

Summary of literature review

Hypertension is a global health problem. Hypertension management is essential to reduce the risk of hypertension related-complications. As it is a chronic condition, life-long management is necessary. There are pharmacological and non- pharmacological methods of hypertension management. Non-pharmacological management includes lifestyle modification behaviors such as eating a healthy diet, physical exercises, stopping smoking, limiting alcohol, reducing obesity etc. Long-term adherence to hypertension management is challenging for hypertensive people. BP self-monitoring as a part of self-care is more informative in terms of measurement variability and could contribute to engage hypertensive people in such hypertension management strategies.

CHAPTER III METHODOLOGY

This structured literature analysis utilized the following electronic databases: Ageline, Proquest, Google Scholar, Academic Search Premier, PubMed, CINNHAL with EBSCO host (See table 1 of Appendix for rationale for database selection).

The topic for the APP "The relationship of Self-monitoring of blood pressure and hypertension control" was decided after doing research on some articles related to self-monitoring of blood pressure. It was found that the people with hypertension are increasing worldwide and need of the knowledge on relationship of self-monitoring of blood pressure and hypertension control to early manage the problem of hypertension globally. The key words were chosen from the topic of the APP. I found the two important keywords "Blood pressure self-monitoring" and "hypertension" from the topic and chose two other key words "lifestyle modification" and "treatment adherence" from the reviewed articles that gave the idea on how hypertension control is achieved. These key words were most relevant to this literature analysis and findings.

Criteria of search: APP will limit the search of the literature review to the following criteria:

1. Hypertension
2. Blood pressure self-monitoring
3. Treatment adherence
4. Lifestyle modification

The search of article was completed by using key words and combination of them (see table 2 of Appendix for used keywords and combined keywords). Full text, peer reviewed, English language, published in 2013 to 2018, and reference available were restriction utilized to add in this paper. The sample population included was adult population aged 30 and above for

people with hypertension. Inclusion criteria for articles were sample population with hypertension, men and/or women, and self-monitoring of blood pressure by people with hypertension. Studies were excluded when the research was not related to self-monitoring of blood pressure, sample was women with hypertension in pregnancy, age below 30 years, and researches that were done before 2013.

Proquest database resulted in total of 4321 studies. Google scholar hit 18,705 studies. Academic search premier resulted in 13,816 articles. Bibliographic search resulted in 5 studies that were duplicated in google scholar. Total 51 studies from proquest, google scholar, and academic search premier database met the inclusion criteria but only 13 studies were included in this paper (see table 2 of appendix for details). Repeated studies were eliminated. Studies with wrong outcome and unable to access were excluded. Pubmed resulted in 219 studies. Ageline resulted in 9 studies. CINAHL hits 112 studies. But inclusion criteria were not met by Pubmed, Ageline and CINAHL.

Overall, this Alternate plan paper (APP) contained recent literary articles demonstrating the effectiveness of self- monitoring of blood pressure in managing hypertension, discussion, and conclusion of findings.

CHAPTER IV RESULTS

The results section will summarize the selected articles that met the purpose of this study. The brief summary will be presented in a table outlining authors, title, methods, and findings. Following the summary table, the narration of each article that includes purpose, method, and results will be presented.

Study	Author(s)	Title	Methodology	Finding(s)
S1	Viera, Tuttle, Voora, & Olsson (2015).	Comparison of Patients' Confidence in Office, Ambulatory and Home Blood Pressure Measurements as Methods of Assessing for Hypertension.	Survey of 193 hypertensive adults on 1 to 9 scale of confidence level on office BP, ABPM, and home BP	The participants put a higher level of trust in home BP and mobile BP appraisal techniques than office blood pressure, might be useful in directing design to analyze hypertension and enhance medication adherence.
S2	Stergiou et al., 2013	Home blood pressure monitoring alone vs. combined clinic and ambulatory measurements in following treatment-induced changes in blood pressure and organ damage	A prospective randomized study included 116 participants of mean age 50.7±10.5 years with untreated elevated BP.	Home BP self-monitoring alone was as dependable as consolidated office and ambulatory BP estimations in observing the impacts of antihypertensive medication treatment and symptomatic target organ damage.
S3	Fletcher et al., (2016).	Self-monitoring blood pressure in hypertension, patient and provider perspectives: A systematic review and thematic synthesis	A systematic review and thematic synthesis of twelve studies were included involving 358 patients and 91 clinicians.	SMBP portrayed as enabling hypertensive individual, helping them in dealing with their BP. SMBP announced as encouraging talk about hypertension with physicians and giving

				hypertensive people all the more understanding to connect blood pressure changes with daily lifestyle behaviors.
S4	Aekplakorn, Suriyawongpaisal, Tansirisithikul, Sakulpipat, & Charoensuk, (2016).	Effectiveness of self-monitoring blood pressure in primary care: A randomized controlled trial.	Randomized controlled trial with 12 months of follow-up in a community hospital. A total of 224 eligible patients with hypertension were randomly allocated to the SMBP (n = 111) and usual care groups (n = 113).	The advantage of the SMBP was found in those matured ≥60 years, which fundamentally diminished in systolic BP by 8.9 mm Hg contrasted to those in the usual consideration. The more noteworthy advantage of SMBP found in older people may be a direct result of the way that they typically stayed more time at home, so they would probably measure blood pressure frequently at home and get feedback.
S5	Uhlig, Patel, Ip, Kitsios, & Balk (2013).	Self-measured blood pressure monitoring in the management of hypertension: A systematic review and meta-analysis.	A Systematic Review and Meta-analysis	The systematic review of 52 trials demonstrated that SMBP with or without extra help, for example, instruction, home visits, telemedicine, guiding, or Web-based logging bring down blood pressure than regular care, yet impacts and long run benefits past a year stay dubious.
S6	Shrestha et al., (2018).	Barriers and facilitators to treatment among patients with newly diagnosed	A qualitative study included seven focus group discussions with 35 patients with newly diagnosed	Absence of sufficient guiding, long-term utilization of drug, and related cost, no family support, sustenance longing for, apathy,

		hypertension in Nepal.	hypertension from December 2015 to February 2016.	occupied calendar and so forth were the hindrances to hypertension treatment. While dread of results, patient's mindfulness and poise, self-reminding methodologies, social help, and suggestions by clinicians were motivational components.
S7	Jacobsa, Sajjada, & Zhenga (2017).	Integration of Home Blood Pressure Monitoring in Hypertension Management.	Retrospective analysis of data. In 2014, the adult medicine department in Boston, MA started a BP screen loaner program with the goal that HBPM would help diagnosing hypertension and titrating medication.	Incorporating HBPM with office-based management of hypertension was clinically significant and may have considerable effect in the precision of diagnosis and the long-term utilization of medicine.
S8	Ayala, Tong, Neeley, Lane, Robb, & Loustalot (2017).	Home blood pressure monitoring among adults—American Heart Association Cardiovascular Health Consumer Survey, 2012.	Survey design: online survey	Optimism towards taking activities to bring down BP was related with increased utilization of HBPM. Positive behavior, for example, acquiring knowledge of the genuine negative results of uncontrolled HTN may build understanding commitment and involvement in self-care.
S9	Fletcher, Hartmann-Boyce, Hinton,	The effect of self-monitoring of blood pressure on medication	Systematic review and meta-analysis	SMBP resulted in small effect on antihypertensive medication adherence.

	& McManus (2015).	adherence and lifestyle factors: a systematic review and meta-analysis.		However, it was significant in controlling hypertension. The SMBP effect on lifestyle behaviors modification was less clear.
S10	McManus et al., (2014)	Effect of self-monitoring and medication self-titration on systolic blood pressure in hypertensive patients at high risk of cardiovascular disease: the TASMIN-SR randomized clinical trial.	Unblinded, randomized clinical trial involving 552 patients in combined self – monitoring and self- titration group as intervention group and usual care group as control group	In intervention group, the SBP and DBP reduction after 12 months were 9.2mmHg and 3.4mmHg in respectively.
S11	McManus et al., (2018)	Efficacy of self-monitored blood pressure, with or without telemonitoring, for titration of antihypertensive medication (TASMINH4): an unmasked randomized controlled trial	Randomized control trial	BP self-monitoring with or without the support of tele monitoring assisted GPs in titrating antihypertensive medicines than usual care to reduce blood pressure.
S12	Tucker et.al, (2017).	Self-monitoring of blood pressure in hypertension: A systematic review and individual patient data meta-analysis.	Individual patient data (IPD) meta-analysis	Incorporating interventions such as changes in lifestyle behaviors and medication titration, self-monitoring was able to decrease blood pressure in

				hypertensives than self-monitoring alone.
S13	DeAlleaume et.al, (2015).	Success in the Achieving CARdiovascular Excellence in Colorado (A CARE) home blood pressure monitoring program: a report from the Shared Networks of Colorado Ambulatory Practices and Partners (SNOCAP)	A quasi-experimental design	The feedback from health care provider based on HBPM program can play a significant role in controlling hypertension and preventing related cardiovascular disease (CVD) risk.

S1

Viera, Tuttle, Voora, & Olsson (2015) conducted a study to compare the perception and confidence on the three methods of blood pressure monitoring: office blood pressure monitoring, home blood pressure monitoring, and ambulatory blood pressure monitoring (AMBP). They surveyed 193 adults of age ≥30 years. All participants had undergone each method of blood pressure measurement. A 1 (not at all confident) to 9 (very confident) scale was used to indicate the confidence level.

The questionnaire items were the beliefs about methods of blood pressure measurement and confidence on the method in identifying effectiveness to hypertension diagnosis and treatment need. Based on the blood pressure measurement method, the questionnaire also had the items that compare the perceived accuracy in improving the effectiveness of treatment and blood pressure control.

There was greater confidence for home blood pressure measurement (median 7) and ambulatory blood pressure measurement (median 8) than office measurement (median 6). Similarly, the home BP and AMBP were perceived to make hypertension diagnosis and improved medication adherence based on the elevated blood pressure (Viera, Tuttle, Voora, & Olsson, 2015).

S2

Stergiou and colleagues (2013) conducted a prospective, randomized study that included 116 participants of mean age 50.7±10.5 years with untreated elevated BP split between two randomized groups: (1) an office BP and AMBP group and (2) a home measurement alone group.

The inclusion criteria were elevated clinic blood pressure of ≥160/100mm Hg after 2 weeks and ≥140/90mm Hg after 4 weeks of initiation of treatment. The baseline data were collected in a 2 week period. Participants underwent for 3 BP measurements in a clinic, a weekly home BP measurement, and a daily AMBP monitoring. A general lab investigation and target organ damage assessment were done immediately after the tests and done once again after a year of treatment. The blood pressure measurement errors and bias were prevented by using validated oscillometric device and standard international protocols.

The results of the investigation depict the comparison between clinic and ambulatory BP with the home BP measurements, with similar BP levels, control rates of hypertension and organ damage after a year. Such facts elucidated that home BP monitoring has similar effects as combined measurements in monitoring the preclinical target organ damage and side effects of antihypertensive drug treatment. The analysis indicated no differences between both strategies

after a follow up of 13.4 months on average. These results were in terms of treatment induced change in organ damage, hypertension control rates and difference in BP (Stergiou et.al, 2013).

S3

The systematic review done by Fletcher and associates (2016) presented the perspectives of people with hypertension and providers on SMBP. Twelve studies were included in the synthesis involving 358 patients and 91 clinicians.

SMBP was taken as a tool that represent the symptoms as patients relate changes in their BP with daily life. People with hypertension having knowledge of the relationship between life style and BP, allowed some of them to experiment with regular exercises and diet (Fletcher et al., 2016). However, both patients and clinicians felt uncomfortable regarding the interpretation of monitoring measurements, especially variability of SMBP measurements in terms of place (home/ office) and period (short and long period of time) of measurement, (Fletcher et al., 2016). Also, how people with hypertension record (wrong interpretation and recording) the blood pressure and communicate to their health care provider (might not explain properly or exaggerate measurement process and reading) remains an issue (Fletcher et al., 2016).

Over all, Fletcher et al., (2016) highlighted that SMBP deals with managing blood pressure in a way that facilitates understanding and discussion about hypertension. Self-monitoring enhances more precise information for health care providers. Such interaction could emphasize the use of SMBP in clinician's acceptance, advice and permission.

S4

Aekplakorn et.al, (2016) completed a randomized control trial study to assess the effectiveness of self-monitoring blood pressure (SMBP) with one year period of follow-up. A total of 224 eligible participants with hypertension (≥140 /90 mmHg) were randomly assigned to

the intervention group (SMBP group) and control group (usual care group). The intervention group received home BP monitors.

While comparing the results from initial, six month and one year blood pressure data, the intervention group had blood pressure reduction greater than usual care group. The participants aged 60 and older were most benefited by home blood pressure monitoring. An 8.9 mm Hg decrease in SBP was found among older participants in SMBP group at one year. Aekplakorn et.al, (2016) concluded that the reason for substantial advantage of home blood pressure monitoring seen among older adults is the more free time. Elderly people have more free time at home to measure BP than employed people and the measurement information could help them to get feedback to be involved in hypertension self-management behaviors and treatment adherence (Aekplakorn, Suriyawongpaisal, Tansirisithikul, Sakulpipat, & Charoensuk, 2016).

S5

Uhlig, Patel, Ip, Kitsios, & Balk (2013) systematically reviewed 52 studies on self-monitoring of blood pressure focusing on effectiveness of self-monitoring alone and with combined support versus usual care in the management of hypertension. They observed 3.9 mm Hg reduction in systolic blood pressure after six months with self-monitoring of blood pressure. While with additional support further reduction in systolic blood pressure of 3.4 to 8.9mm Hg at six months was observed. The additional supports utilized were counselling, hypertension education, home visit, and telemedicine. Compared to usual care, self- monitoring alone and/or additional supports reduced the blood pressure. However, the long term blood pressure management beyond the year remained uncertain (Uhlig, Patel, Ip, Kitsios, & Balk, 2013).

S6

A qualitative investigation by Shrestha and colleagues (2018) among 7 focus group discussion (FGDs) included 35 recently diagnosed hypertensive people during 3 months span. This discussion emphasized the barriers and facilitators at hypertension treatment with the help of thematic analysis of data.

The study pointed to various obstacles at treatment of hypertension. The focus group discussion reported the main individual-level obstacles which include challenges in behavior modification such as smoking, drinking alcohol, food craving, lack of exercise due to laziness, busy schedule and comorbidities like musculoskeletal pain hindering the physical activities. Seriousness of hypertension is another obstacle or barrier. Hypertension was not taken seriously by participants until a sudden complication occurred. Likewise, the reason for lack of taking medicine after diagnosis was one of its long term intake and associated cost. So change in regular exercise and diet was preferred over visiting the hospital. There were also sociocultural barriers like feasts and festivals, drinking at social events, and no family support. Lack of appropriate counselling from providers, preference to senior doctors, providers' negative behaviors, and unaffordability of treatment are some barriers from health care related factors (Shrestha et al., 2018).

Perceived fear of negative results of uncontrolled hypertension, self-knowledge, and supportive counselling by health care providers are some motivational factors highlighted in the study for adherence to hypertension management. For self-motivation, participants applied cell phone reminder systems, carrying medicine every day, and bedside medicine strategies. FGDs illustrated the role of family and society to engage hypertensive in hypertension management behaviors (Shrestha et al., 2018).

S7

Jacobsa, Sajjada, & Zhenga, (2017) conducted a study to evaluate the effectiveness of home blood pressure monitoring integrating with clinic hypertension management. Primary care providers referred the 99 participants to clinical pharmacists. Pharmacists provided hypertension education (if relevant), reviewed the medication and provided home blood pressure monitoring instruction, and a bag with blood pressure monitoring equipment ncluding every detail written in pamphlets to monitor blood pressure at home. At clinic visits, pharmacists kept the electronic record of blood pressure to enable decision making. Pharmacists discussed the information with the participant and health care provider for any medication changes.

Among 75 included participants, 41 were referred to their provider for medicinal adjustment and 34 for confirmation of hypertension diagnosis with the help of home blood pressure monitoring. 50% of participants who were referred for medication management had undergone medicinal adjustment. 68% of the participants referred for hypertension diagnosis confirmation did not have hypertension and no need of medication prescription.

Overall, Jacobsa, Sajjada, & Zhenga, (2017) suggested that accuracy in hypertension diagnosis and antihypertensive medication adjustment can be facilitated by integration of home blood pressure monitoring. Clinical importance of home blood pressure monitoring can result in effective hypertension control and involve people in self- care.

S8

Ayala et al., (2017) designed an online survey to assess the home BP monitoring among people with hypertension. Survey questions were related to home blood pressure monitoring, actions taken to manage hypertension, and attitudes towards blood pressure reduction actions to lower the risk of hypertension related complications such as stroke or heart attack. 559

participants reported they have hypertension and 437 were on antihypertensive medication. Of the 559 participants 303 were using home BP monitoring.

People with hypertension, especially the older adults were more concerned about their health (2.46 times more), and the negative consequences of hypertension (2.44 times more). They reported being involved more often in home BP monitoring than their counterparts. The study results explicated the self-reported survey of home blood pressure monitoring and it's association with age, visit to health care provider and positive attitude towards reducing BP. The people like employed young adults who are out of touch with a health facilitator within the past year, are less conscious about HBPM then others.

Ayala et al., (2017) concluded with the need of patients to check BP at home for which health facilitator need to provide education about its importance, which reduces the risk of cardiovascular disease.

S9

Fletcher, Hartmann-Boyce, Hinton, & McManus, (2015) completed a meta analysis of 28 randomized and quasi-randomized trials with a total of 7021 participants in identifying the effectiveness of self-monitoring of blood pressure compared to usual care in controlling hypertension. The follow up visit frequency ranged from two weeks to one year with average of six months. Self- report, pill count, and pharmacy fill data were the methods of assessing the antihypertensive medication adherence.

Though self-monitoring of blood pressure resulted in a small effect on medication adherence it was significant in controlling hypertension. The extent to which the SMBP can affect medication adherence remain uncertain (Fletcher, Hartmann-Boyce, Hinton, & McManus, 2015).

Fletcher, Hartmann-Boyce, Hinton, & McManus, (2015) presented that SMBP could less likely affect the lifestyle factors such as diet and physical activity. SMBP outcomes might be affected by other mediators such as provider's prescriptions.

S10

McManus et al., (2014) conducted a randomized control trial to compare the effectiveness of self-monitoring of blood pressure with self-titration of medication versus usual care in managing hypertension among the people with hypertension who were at risk of developing cardiovascular diseases.

The study included 552 people with hypertension who were receiving medical treatment and had a history of hypertension related complications. The intervention group self-monitored their blood pressure and self-titrated their medicines using self-titration algorithm. While the control group was in usual care of hypertension management.

In the intervention group and control group, the baseline average blood pressure was 143.1/80.5 mm Hg and 143.6/79.5 mmHg respectively. After a year, the SBP and DBP was reduced by 9.2 mm Hg and 3.4 mmHg in intervention group. While in control group the reduction was 8.8 mm Hg for SBP and 3.1 mmHg for DBP. They found significant reduction of SBP by 0.4 mm Hg and DBP by 0.3 mm HG in intervention group than control group. (McManus et.al, 2014).

Their study indicated that self-titration of antihypertensive medicines with the help of self-monitoring of blood pressure supported bringing down the blood pressure in the high risk of development of cardiovascular disease group (McManus et al., 2014).

S11

McManus et al., (2018) conducted a randomized control trial in primary care to investigate the effectiveness of blood pressure self-monitoring with or without help of tele-monitoring versus usual care in titration of antihypertensive medicines. 1,182 participants were randomly assigned to three groups: self-monitoring alone, self- monitoring with tele-monitoring, and usual care group. The outcome was based on systolic blood pressure results measured in primary care after one year.

The baseline systolic blood pressure was higher than 140/90 mmHg. After a year they found decreased systolic blood pressure in both self- monitoring (137mmHg) and self-monitoring with the tele-monitoring group (136 mmHg) than the usual care group (140.4 mmHg). The result was similar in both intervention groups (McManus et al., 2018).

Overall, for antihypertensive medication titration, this study supported the use of blood pressure self-monitoring with or without the help of tele-monitoring in managing hypertension than clinic measurement of blood pressure.

S12

Tucker and associates (2017) reviewed the randomized control trial studies utilizing the electronic database to investigate the blood pressure self-monitoring effectiveness. They searched all the studies published since 2000 with at least 100 participants in each study and a 6 month follow-up period. The criteria were met by 36 studies. Tucker et al., (2017) found the association between blood pressure self-monitoring and hypertension reduction. Based on systolic blood pressure, they observed a 3.2 mmHg reduction in the intervention group while only a 1.6 mmHg reduction in the usual care group. However, co-interventions induced blood pressure reduction was higher (6.1 mmHg) than self-monitoring alone (1 mmHg). Applied co-interventions were counselling on lifestyle modifications, self-involvement in hypertension

management, or antihypertensive medication titration by health care provider. Tucker et al., (2017) also observed that the participants who were taking less antihypertensive medicines and had higher baseline systolic blood pressure (170 mmHg) benefited by blood pressure self-monitoring for up to one year.

S13

DeAlleaume et al., (2015) completed a quasi-experimental design study to evaluate the effectiveness of the home blood pressure monitoring program among 3,578 people with hypertension or cardiovascular disease risk adults. Achieving CARdiovascular Excellence (A CARE) HBPM program distributed the validated home blood pressure monitoring device to all participants and received the reports of mean blood pressure readings from participants monthly (DeAlleaume et al., 2015). The nonparticipants were on usual care. Based on the reports, health care providers assessed the changes in home and clinic BP and provided with immediate feedback to A CARE program participants. The feedback was based on the targeted BP goal, comparison with previous reports, and graphic presentation of blood pressure.

Initial average home BP was 137.6/83 mmHg and clinic BP was 141.5/84.4 for all participants and participants with diabetes was 142.3/ 83.0 mmHg. A CARE HBPM program participants had a decrease in home blood pressure by 6.5/4.4 mmHg in one year. The hypertensive participants with diabetes also had similar effects of reduction in both systolic and diastolic blood pressure (6.7/4.7 mmHg) representing HBPM program's usefulness in reducing cardiovascular disease risk. Likewise, clinic BP reduced by 6.3/4.1 mmHg for all participants and 5.9/3.6 mmHg for participants with diabetes. For the non- participants including people with hypertension with diabetes, the observation in systolic and diastolic blood pressure changes were not significant (DeAlleaume et al., 2015).

Overall, DeAlleaume et al., (2015) demonstrated the positive impact of HBPM along with health care provider feedback in controlling hypertension and reducing cardiovascular event risk.

Summary of Results

This chapter demonstrated that blood pressure self-monitoring has an important role in managing hypertension. SMBP has many advantages for both health care providers and people with hypertension. It is helpful in diagnosing hypertension as well as making treatment decisions. The reviewed articles also emphasized that co-interventions such as feedback from health care provider, education and counselling are more effective in controlling hypertension than SMBP alone.

CHAPTER V DISCUSSION AND CONCLUSION

The objective of this structured literature analysis was to show whether blood pressure self-monitoring is related to hypertension control. The review of 13 articles demonstrated a positive relationship between blood pressure self-monitoring and hypertension management. The authors were able to demonstrate the effectiveness of SMBP in reduction of blood pressure in hypertensive participants. The studies reviewed mainly focused on effectiveness of SMBP in reduction of BP in terms of medication adherence and decreasing cardiovascular risk of uncontrolled hypertension. The studies included were not directly focused on lifestyle modification behaviors as the benefits of SMBP and had less evidence on it. The study findings indicate there are benefits of SMBP for both people with hypertension and health care providers.

Blood pressure self-measurement can be a better tool to build trust and confidence in people with hypertension than a clinic and ambulatory method of blood pressure measurement (Viera, Tuttle, Voora, & Olsson, 2015). As SMBP helps to relate the blood pressure changes with daily life activities (Fletcher et al., 2016), people know about their health state and can be more conscious about their health to engage in self-management behaviors.

With the help of self- monitoring of blood pressure, people with hypertension even can self-titrate the antihypertensive medications. McManus et al., (2014) found the significant reduction of blood pressure in the intervention group who were well trained on self-titration of antihypertensive medicines provided with algorithms on the basis of blood pressure self-monitoring.

People with hypertension can use the SMBP for a day to day observation to monitor progression enhance medication adherence, and allow prompt response from health care

providers in regard to diagnosis and treatment effectiveness. SMBP is an easy, less time consuming method of hypertension management in everyday life (Imai, Hosaka, Elnagar, & Satoh, 2014).

Continuous encouragement and motivation from health care providers is very helpful in self-monitoring of blood pressure for people with hypertension. Tucker et al., (2017) and Huff et al., (2011) largely supported this statement. Tucker et al., (2017) found significant reduction of blood pressure (6.1 mm Hg) when people with hypertension were well supported by health care providers in intervention group compared with usual care. People with hypertension were followed up by health care providers with telephone counselling and education about self-monitoring of blood pressure. Similarly, Huff et al., (2011) found the motivational education, counselling, and reinforcement by health care provider on use of home BP monitoring and reporting habit were effective in increasing hypertensive participation (3 times more reporting habits among surveyed non-reporters than non-surveyed non-reporters) in home blood pressure monitoring program.

Conclusion

Chronic disease conditions are burdensome to people, communities, nations, and the world. Hypertension self-awareness, early diagnosis and self-management can prevent and control hypertension. This literature analysis found a correlation between SMBP and hypertension control. Health care providers can use SMBP in diagnosing hypertension and monitoring effectiveness of antihypertensive medication while the combined efforts with other interventions such as motivational counselling, education about hypertension, and active involvement of health care professionals result in better hypertension control. Proper guidance on SMBP is essential as it can eliminate confusion on blood pressure readings and anxiety from

having to self-monitor. Likewise, SMBP motivates people with hypertension to engage in regular monitoring that facilitate discussion about hypertension with health care providers which may lead to lifestyle changes and medication adherence that promote better understanding of their health state and hypertension management. The diagram below shows how BP self-monitoring is associated with hypertension control.

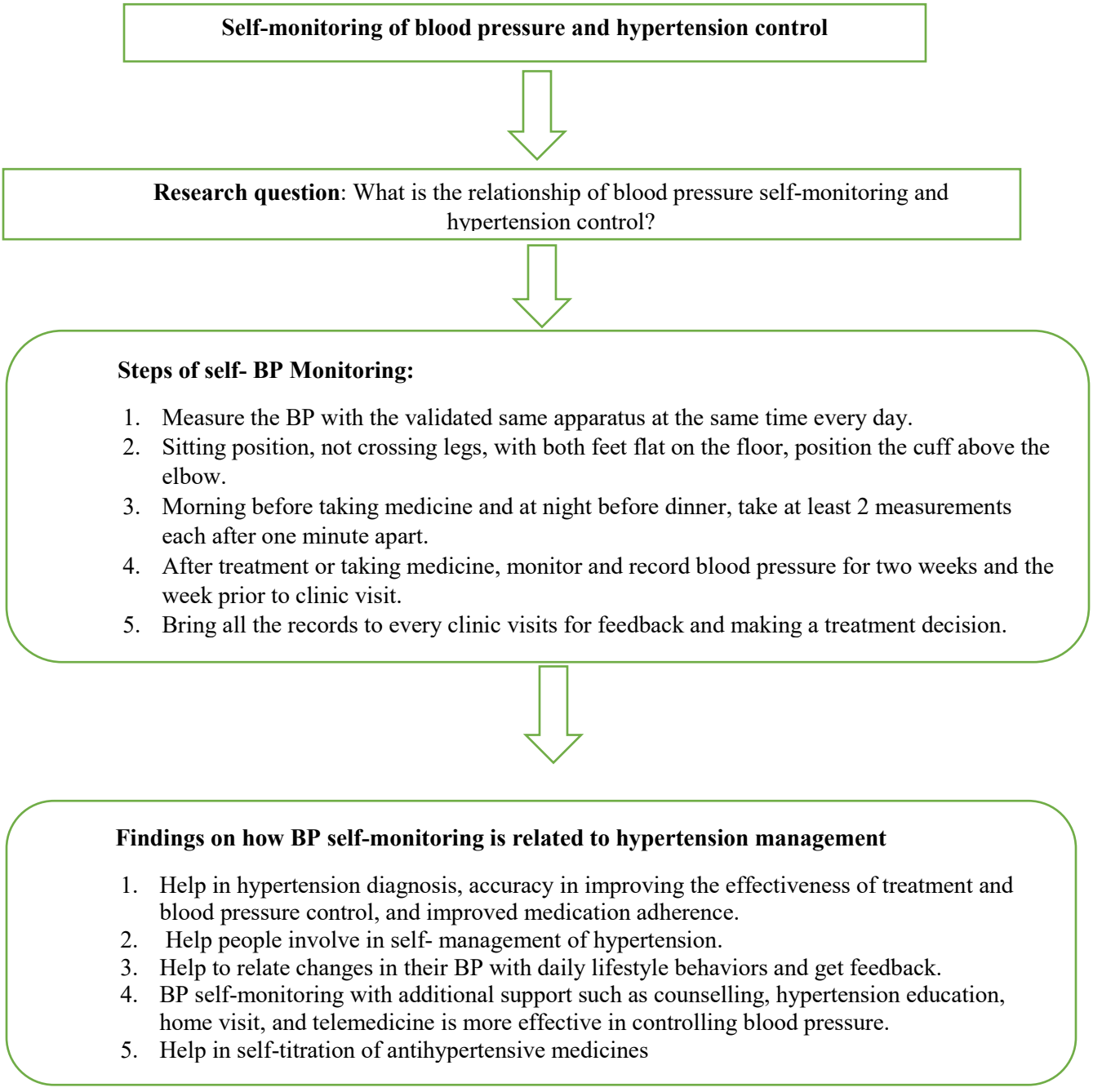

Diagram 1: Association of self-monitoring of blood pressure and hypertension control.

Benefits of the literature analysis

The reviewed literature has provided the association of SMBP with hypertension control. Acknowledging the benefits of SMBP in hypertension management, this paper can benefit people with hypertension as well as health care providers in many ways, which includes:

1. Build confidence and self-motivation in people with hypertension to control hypertension by engaging in hypertension self-care behaviors
2. Help health care providers in diagnosing white-coat and masked hypertension before initiating treatment
3. Help to monitor the effectiveness of medications and lifestyle changes as well as antihypertensive medication titration
4. Help to prevent cardiovascular related complications in high risk people and reduce medical care cost.

Limitations

The reviewed articles had several limitations within themselves that could also limit the aim of this paper: Lack of representative sample (Viera, Tuttle, Voora, & Olsson ,2015; Aekplakorn, Suriyawongpaisal, Tansirisithikul, Sakulpipat, & Charoensuk, 2016), no inclusion of very high risk people with comorbidities and short term follow-up (Stergiou et al., 2013), use of different SMBP protocols in studies are some limitations that impede generalizability of results. Control variables such as socioeconomic status of sample, education, occupation, and

income, SMBP knowledge, technique, recording and interpretation may have influenced the hypertension management.

Future recommendations

SMBP usefulness in both clinic and in people with hypertension level is most impactful in hypertension management. It potentially leads to better hypertension control. SMBP alone can be as effective as other hypertension measurement methods such as AMBP and office BP measurement in control of hypertension (Stergiou et al., 2013). As many people may not have known optimal BP measurement technique, the approach from the health care system for simple education, instructions, and training on SMBP could motivate the people to engage in blood pressure self-monitoring. In spite of the fact that SMBP could cause stress and anxiety in people with unmanaged hypertension, it is equally useful in getting knowledge on the relation of blood pressure and daily lifestyle behaviors. As the reviewed articles are mostly directed towards antihypertensive medication adherence, research should be more focused on showing the relationship of SMBP with each lifestyle change such as alcohol consumption, diet, exercise, and body weight etc. More research should be done on combined clinical and research based clear guidelines on SMBP. The research should also focus on the effectiveness of SMBP in older adults with hypertension alone and with comorbidity as the participants in reviewed articles are mostly a mix of middle to old age adults.

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Appendix

Table 1 Database search description

Database (or search engine)	Restriction added to search	Dates included in database	General subjects covered by Database
CINAHL	Full text Peer reviewed	2013 to 2018	Provides full text access to e-books about nursing and 29 core nursing journals. Also provides citations and abstracts to articles, books, dissertations, proceedings, and other materials about all aspects of nursing and allied health, including cardiopulmonary technology, emergency service, health education, medical/laboratory, medical assistant, medical records, occupational therapy, physical therapy, physician assistant, radiologic technology, social service/health care, and more.
Proquest database	Full text Peer reviewed	2013 to 2018	Searches 33 ProQuest databases for a variety of topics.
Ageline	Full text Peer reviewed English language	2013 to 2018	Provides citations & abstracts to articles, books, & other materials about all aspects of gerontology
Academic Search Premier	Full text Peer reviewed English language	2013 to 2018	Provides citations and abstracts to articles, as well as full text of articles from over 4,600 publications, covering almost every academic subject. *This resource is provided by the Electronic Library of Minnesota, freely accessible to anyone in Minnesota!*
Pubmed	Full text	2013 to 2018	Provides citations, abstracts, and selected full text to articles about "medicine, nursing, dentistry, veterinary medicine, the health care system, and the preclinical sciences."
Googlescholar	Full text Include citations	2013 to 2018	"Google Scholar enables you to search specifically for scholarly literature, including peer-reviewed papers, theses, books, preprints, abstracts and technical reports from all broad areas of research. Use Google Scholar to find articles from a wide variety of academic publishers, professional societies, preprint repositories and universities, as well as scholarly articles available across the web."

Table 2 Data Abstraction Process

Key words	Hits in CINAHL	Proquest Database	Ageline	Pubmed	Google Scholar	Academic search premier	Total
Blood pressure self-monitoring	94	1713	1	132	18300	12214	
"Blood pressure self-monitoring" AND "Hypertension"	13	861	8	61	300 ***7**	578 ***4**	
"Blood pressure self-monitoring" AND "Lifestyle modification"	1	486 ***3**	-	8	43 ***5**	318 ***3**	
"Blood pressure self-monitoring" AND "Treatment adherence"	3	923 ***7**	-	16	48 ***3**	498 ***3**	
"Blood pressure self-monitoring" AND "Lifestyle modification" AND "Treatment adherence"	1	341 ***4**	-	2	14 ***3**	208 ***4**	
Bibliographic search					***5**		
Total	111	4324 ***14**	9	219	18,705 ***23**	13816***14**	***51**

***BOLD** = articles matched for inclusion criteria